

Claims

What is claimed is:

1. A method for adjusting pre-load of a spring, comprising:

5 coupling a piezoelectric device with a spring; applying a voltage to the piezoelectric device to cause the piezoelectric device to undergo a physical dimensional change that changes the pre-load of the spring; and

10 adjusting the pre-load of the spring by selectively varying the voltage applied to the piezoelectric device.

2. The method of claim 1 wherein the piezoelectric device comprises a thermally pre-stressed
15 bender actuator.

3. The method of claim 1 further comprising increasing the voltage applied to the piezoelectric device to one of increase and decrease the pre-load of the spring.

20 4. The method of claim 1 further comprising decreasing the voltage applied to the piezoelectric device to one of increase and decrease the pre-load of the spring.

25 5. The method of claim 1 further comprising coupling at least a predetermined portion of the piezoelectric device with a fixed structure.

6. A method for adjusting pre-load of a spring, comprising:

coupling a first piezoelectric device with a first spring;

5 coupling a second piezoelectric device with a second spring;

applying respective predetermined voltages to each of the first and second piezoelectric devices to cause the first and second piezoelectric devices to
10 undergo physical dimensional changes that exert a predetermined respective pre-load on the first and second springs.

7. The method of claim 6 further comprising applying respective voltages to the first piezoelectric
15 device and the second piezoelectric device such that the first spring and second spring exhibit generally the same pre-load.

8. In combination, at least one piezoelectric device and a spring coupled with the piezoelectric
20 device, whereby the piezoelectric device is operable to undergo a physical dimensional change upon application of a voltage to the device that adjusts the pre-load of the spring.

9. The combination of claim 8 wherein the
25 piezoelectric device comprises a thermally pre-stressed bender actuator.

10. The combination of claim 8 further comprising a support structure operatively connected to selected portions of the piezoelectric device.

11. A pre-loaded spring mechanism, comprising:
5 a piezoelectric device operable to undergo a physical dimensional change upon application of a voltage thereto; and

10 a spring coupled with the piezoelectric device, wherein pre-load of the spring is adjusted by varying the voltage applied to the piezoelectric device.

12. The pre-loaded spring mechanism of claim 11, further comprising a voltage source coupled with the piezoelectric device.

15 13. The pre-loaded spring mechanism of claim 11, wherein the piezoelectric device comprises a thermally pre-stressed bending actuator.

14. A method for biasing a spring, comprising:
coupling a piezoelectric device with the
spring; and

20 deforming the piezoelectric device so as to apply a predetermined force to the spring.

15. The method of claim 14 wherein deforming the piezoelectric device comprises applying a voltage to the piezoelectric device sufficient to cause the
25 piezoelectric device to change a physical dimension.

16. The method of claim 14 wherein the piezoelectric device comprises a thermally pre-stressed bender actuator.

17. An apparatus for biasing a spring,
5 comprising:

a piezoelectric device operable to deform as a function of a control signal;

10 a spring coupled with the piezoelectric device and operable to be biased to a predetermined extent as a function of the deformation of the piezoelectric device.

18. The apparatus of claim 17 wherein the control signal comprises one of a voltage and a current.

19. The apparatus of claim 17, further comprising a mass coupled with the spring, the mass
15 operable to be biased as a function of the biasing of the spring.